Introducing Sequencing within The Advanced Scheduling Curriculum

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Scheduling is one of the most important factors within the construction industry. The current Advanced Scheduling curriculum addresses how to use the program P6, but not the understanding of how to sequence. This project introduced two new lab activities that focus on the understanding of sequencing while using P6. I chose this project because I have always had an interest in scheduling as it is one of the most important driving factors in construction and after taking Advanced Scheduling in my Junior year I noticed there is a need for understanding sequencing. I wanted to introduce a new curriculum because I think there is room for improvement within the current curriculum, specifically scheduling. Each activity is scope specific requiring more critical thinking on sequencing and activity selection. Each activity was based on a past project from the 2019 Mixed-Use ASC Region 7 Competition. After analyzing the plans each activity consisted of specific detailed plans focused on creating critical thinking for students to plan and sequence specific scopes while creating reliable and realistic activity durations. These two lab activities introduces new critical thinking skills while teaching the necessary tools for sequencing.

Key Words: CPM, Sequencing, Scheduling, P6, Critical Path

Introduction

In the past year, after engagement with former students that have taken Advanced Scheduling along with my own previous experience, it is seen that students had a lack of understanding of sequencing within schedule. This led me to create two new lab activities to be incorporated into the Advanced Scheduling Curriculum that teach the understanding of sequencing. The primary goal is to create a new understanding of sequencing by reading specific details on plans resulting in an overall schedule. The secondary goal is to provide a deeper understanding of plan reading, more specifically within the Window Details and the overall Concrete Structural Plan. By combining the two goals, students will develop critical thinking and problem-solving attributes that they can use in the workforce after graduation. The two new activities are designed to create a larger interest in scheduling and develop new attributes which will be used within their careers

Background

In accordance with the Senior Project standards and the "Learn by Doing" motto, the creation and revision of a new curriculum was an opportunity for myself and other students to begin to gain experience of scheduling through a hands-on process. After the 2019 ASC Region 7 Competition, the opportunity to take over the scheduling position within Mixed-Use was available. This created a new interest in scheduling for me. This led to myself taking the Advanced Scheduling Course in Spring of 2019.

Following the 2019 Spring quarter, I noticed some gaps within the overall curriculum of Construction Management and more specifically the Advanced Scheduling course. As the school year of 2020 came around the opportunity arose of reconstructing the Advanced Scheduling course by adding new activities. These activities led to more understanding of sequencing and activity durations rather than the use of P6 and understanding how to put together a schedule.

During the 2020 academic school year, the opportunity of grading the Advanced Scheduling course arose. This created a deeper understanding of how it has changed over the last year, due to the virtual class requirements. After the examination of new assignments and an updated syllabus from Professor Andrew Kline, there were specific areas that needed adjustments. After talking with Professor Andrew Kline along with Phil Barlow, the Senior Project was approved.

This opportunity served as an experience allowing students to understand the necessity of sequencing and activity durations. The addition of these lab activities creates more critical thinking opportunities in scheduling, furthering the excellence of Cal Poly Construction Management students.

Project Purpose

To increase the overall excellence of Cal Poly Construction Management students through improving the Cal Poly Construction Management curriculum. Also, to improve the education of scheduling within Construction Management, specifically within the areas of sequencing and activity duration. Students seeking hands-on experience, more specifically within scheduling, will excel by applying themselves and adopting the challenges that are associated with the two new lab activities. The overall project encourages students to increase their education within scheduling and construction management.

Project Steps/Deliverables

The focus of the lab activities is to introduce new knowledge for sequencing within scheduling. Given this, the first step of creating the two new activities was to identify specific activities that are small in duration but require proper sequencing to be successful. To choose the necessary lab activities that achieve this goal, there were two necessary steps. Firstly, was to contact personnel in the construction industry about specific activities that require proper sequencing. Following this, the plans for Window Details were selected along with the Concrete Parking Structure. After the selection of the two scopes, the plans from the 2019 Mixed-Use ASC Region 7 Student Competition were selected for analysis. Once the analysis of the plans was finished, the development of the overall schedules began. The two specified schedules would be used for the base schedule that the students will be graded on. After multiple meetings with industry personnel, the schedule sequencing was created followed by the creation of the overall schedule within the P6 program. Two scopes specified schedules were created,

those being the Window Detail Schedule and the Concrete Parking Structure Schedule. Within the Window Detail schedule, there is a total of 19 activities sequenced together resulting in a total duration of 21 total days.

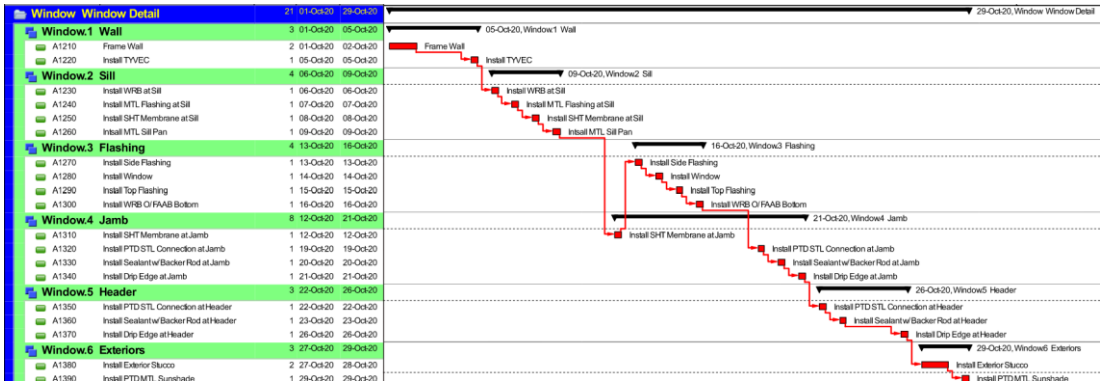

Figure 1. Window Detail Schedule

For the Concrete Parking Structure, a different processed was used. The parking structure required proper concrete sequencing firstly. After the analysis of the plans, the concrete sequence plan was produced following the subcontractors pour capacity that was given in the 2019 Mixed-Use ASC Region 7 problem statement. Once the proper sequence was created the overall specified schedule followed the sequence plan resulting in the overall specified schedule containing 33 total activities with 73 total days in duration.

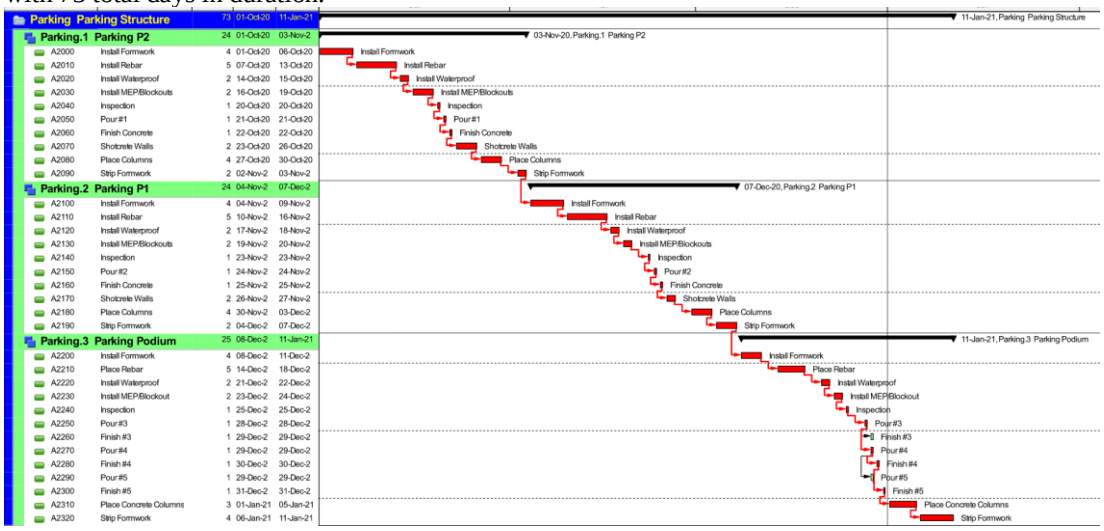

Figure 2. Concrete Parking Structure Schedule

Once the base schedules were created, the process of developing assignment instructions began. The main goal was to provide students the opportunity to analyze specific scopes of work allowing them to sequence activities in the proper order. This required the assignment instructions to contain specific instructions stating the specific scopes that will be scheduled along with a specific overall duration timeline. The instructions also state a required one paragraph write up about the reasoning behind the student's sequencing. This requires students to analyze their assignment before they turn in the final

product. It was determined that it would be most beneficial for the students to be given sheets highlighted with specific details, sequence plans, and proper instructions which do not contain any durations for activities. By using these resources, it requires students to use critical thinking skills to analyze the plans and create their activities with estimated durations. The main goal was to provide students the opportunity to analyze specific scopes of work allowing them to sequence activities in the proper order and understand the duration of each activity. Upon the finish of the overall Lab Activity instructions, the necessary grading rubric for each activity needed to be created. Each activity required separate rubrics as the separate scopes of work required vastly different analyses. This required a brief analysis of the current activities along with the proper grading rubrics. After the analysis of the current activities and rubrics, the two grading rubrics were created. The Window Detail Schedule required proper sequencing to fulfill the specified overall duration, competition of a minimum of four work breakdown structures, accurate activities, and proper print layout along with a one-paragraph write up. The Concrete Parking Garage Schedule required proper sequencing to fulfill the specified overall duration, competition of a minimum of three work breakdown structures, accurate activities, and proper print layout along with a one-paragraph write up. After the creation of the rubrics the overall Lab Activities were fully complete, it required an overall review. Within this review, there was a brief analysis of both rubrics and assignment instructions which resulted in a minimum amount of changes leading to the final completed project

Window Detail Sequencing

Criteria	Ratings				Pts
Overall Completion, Minimum of 4 WBS	10.0 pts Excellent	8.0 pts Missing a Few (not clear)	6.0 pts Below Minimum Standards	3.0 pts Missing/Not Complete	10.0 pts
Accurate Activities - Pulled from Plans, Photos, Submittal	10.0 pts Excellent	8.0 pts Met Minimum Standards	6.0 pts Below Minimum Standard	2.0 pts Missing/Not Complete	10.0 pts
Activities Sequenced Correctly (Within 21 Days)	5.0 pts Excellent	3.0 pts Met Minimum Standards	1.0 pts Missing/Not Complete		5.0 pts
Print Layout/One Paragraph Write Up	5.0 pts Excellent	2.0 pts Missing/Not Complete			5.0 pts
					Total Points: 30.0

Figure 3. Window Detail Grading Rubric

Concrete Parking Garage

Criteria	Ratings				Pts
Overall Completion, Minimum of 3 WBS	10.0 pts Excellent	8.0 pts Missing a Few (not clear)	6.0 pts Below Minimum Standards	3.0 pts Missing/Not Complete	10.0 pts
Accurate Activities - Pulled from Plans, Photos, Submittal	10.0 pts Excellent	8.0 pts Met Minimum Standards	6.0 pts Below Minimum Standard	2.0 pts Missing/Not Complete	10.0 pts
Activities Sequenced Correctly (Within 80 Days)	5.0 pts Excellent	3.0 pts Met Minimum Standards	1.0 pts Missing/Not Complete		5.0 pts
Print Layout/One Paragraph Write Up	5.0 pts Excellent	2.0 pts Missing/Not Complete			5.0 pts
					Total Points: 30.0

Figure 4. Concrete Parking Garage Grading Rubric

Conclusion

Over the duration of the development of this project, I recognized that this is an overall success as it created new opportunities in an area of the Cal Poly Construction Management Curriculum which lacks a full understanding of scheduling, more specifically in sequencing and activity duration selection. While this is only two new lab activities it propels the curriculum forward to develop a new curriculum focused on sequencing and other necessary skills involved in scheduling. These activities will help prepare students for the construction industry and will allow students to form Cal Poly to adapt quickly within the industry. This project is a steppingstone for the overall program at Cal Poly as it creates a larger interest in scheduling and will create more opportunities for other classes to develop more specific scheduling assignments. Throughout this project, I recognized the overall process of scheduling. This allows me to understand the overall importance of sequencing and how much it can change the overall project duration. After focusing on the small details, it would be more beneficial to have students focus on smaller scopes of work and understand the reasoning behind the sequencing rather than a full project. This creates more of an understanding of the reasoning behind the order of activities rather than a broad overall schedule. The adaptation of a larger project throughout the quarter would also be beneficial. More specifically the use of activities with smaller scopes of work that combine into an overall larger project schedule. This would create a larger understanding of sequencing rather than P6 program use. The overall proposed lab activities are an overall success and steppingstone for the curriculum and will benefit the students with the Cal Poly Construction Management program.

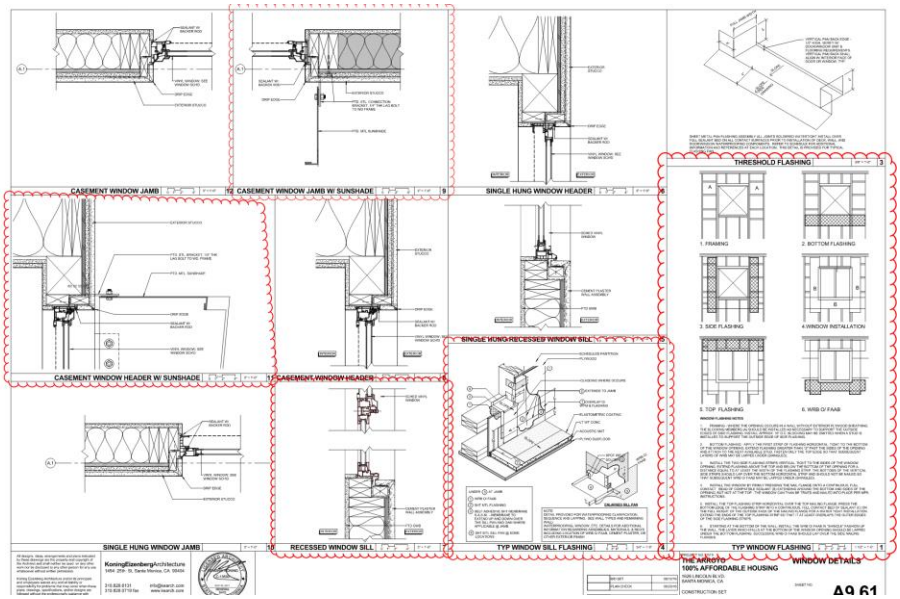

Figure 5. Window Detail Plans

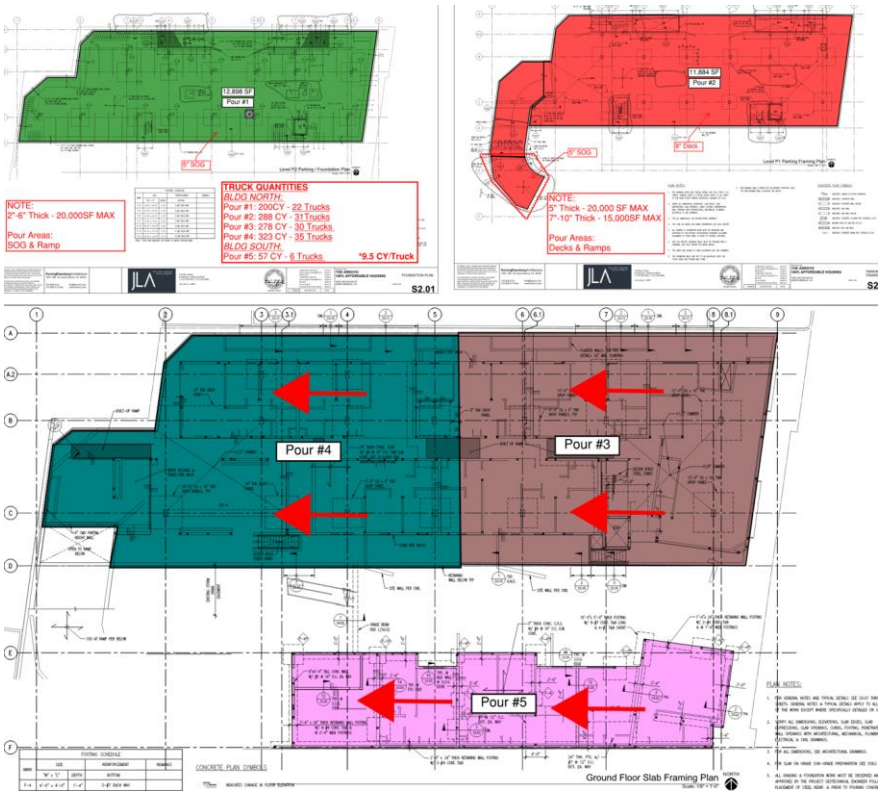

Figure 6. Concrete Parking Structure Sequence Plan

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Concrete Parking Garage - 30 Points

Learning Objectives:
1) Start to understand Concrete Pours and how to sequence work

Part 1: Create CPM schedule for the Concrete for attached Parking Garage. - Submit a pdf

All activities are within the plans. Review the plans and then create schedule. Each activity that takes less than one day count as one day (inspections).

Refer to the pour sequence provided. (Look at the Cubic Yards)

I. WBS - create a WBS for each Level of the Garage
II. Create a logical sequence from the plans that finishes within 80 total days.

Part 2: Create a one paragraph write up explaining your sequence.

Deliverable(s):
1) Part 1 - pdf of your schedule
2) Part 2 - pdf of your one paragraph reasoning

Figure 7. Lab Activity Concrete Parking Garage Schedule

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Window Detail Sequence - 30 Points

Learning Objectives:
1) Start to understand window details and how to sequence work

Part 1: Create CPM schedule for an A2 window from the attached window details. - Submit a pdf

(All activities are within the plans. Review the plans and then create schedule. Each activity that takes less than one day count as one day.)

I. WBS - create a WBS for each part of the window (Jamb, Sill, etc.)
II. Create a logical sequence from the plans that finishes within 21 total days. (Start with Frame Wall. Finish with Install Sunshade.)

Part 2: Create a one paragraph write up explaining your sequence.

Deliverable(s):
1) Part 1 - pdf of your schedule
2) Part 2 - pdf of your one paragraph reasoning

Figure 8. Lab Activity Window Detail Sequence